

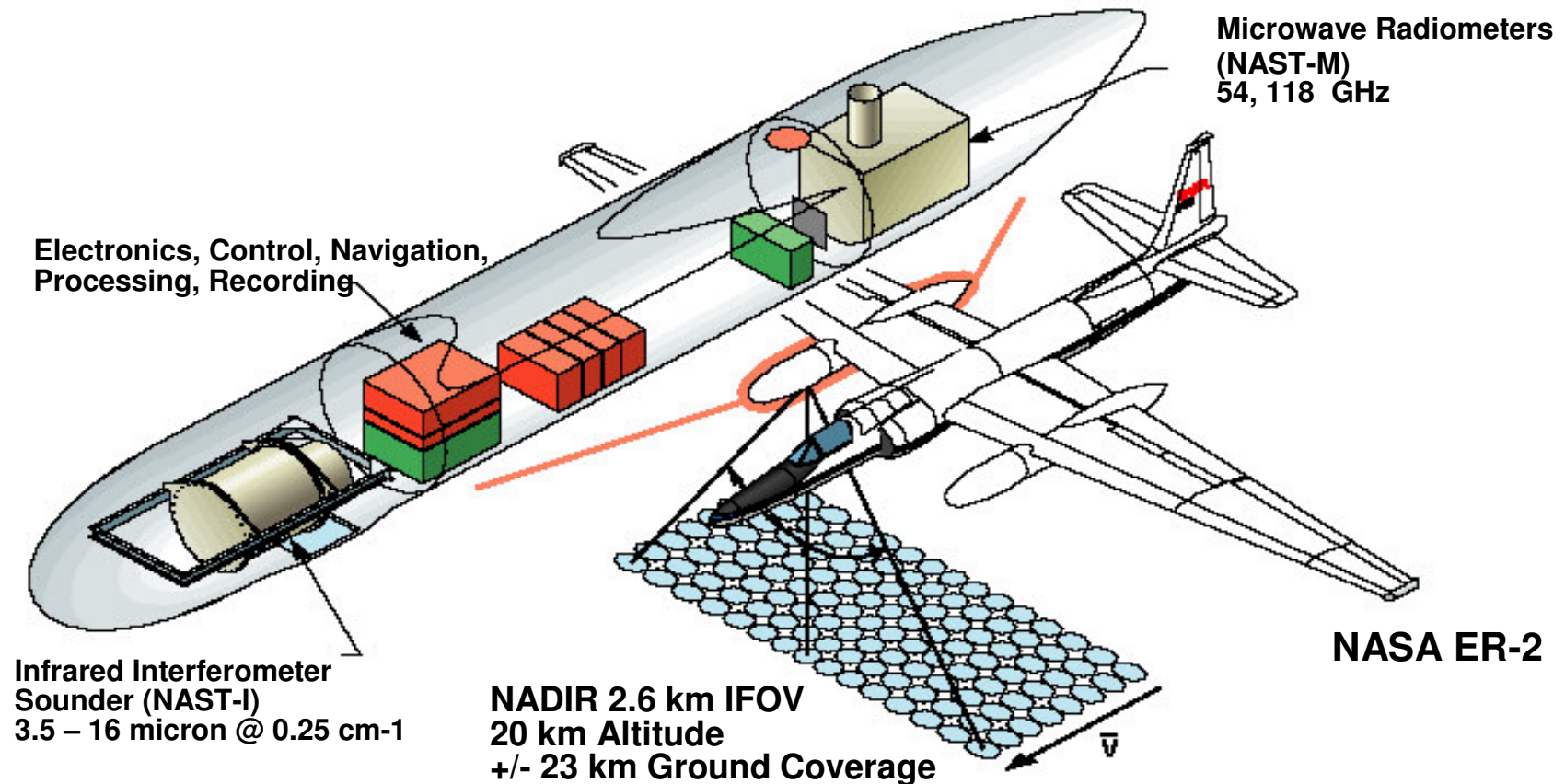


The CRYSTAL-FACE Science Team Meeting
24 – 28 February 2003
Salt Lake City, Utah

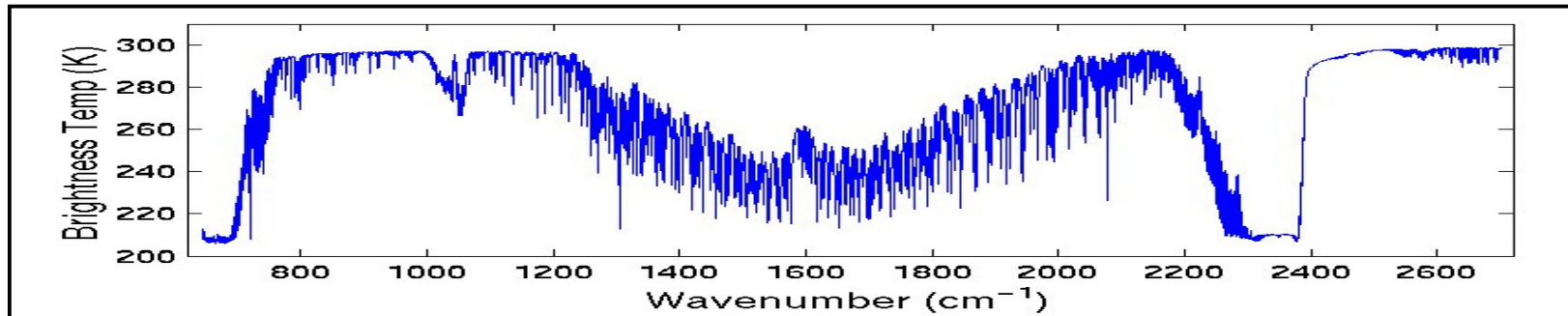
Tropospheric Trace Species Observed with NAST-I During CRYSTAL-FACE

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NPOESS Airborne Sounder Testbed (NAST)

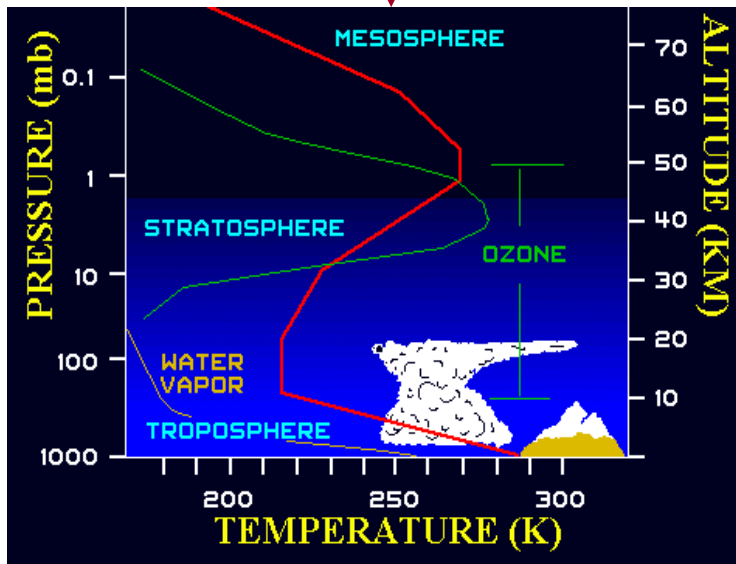


NAST-I Data Products



Calibrated Brightness Temperature or Radiance Spectrum

NUMERICAL INVERSION



Vertical Sounding and Surface properties

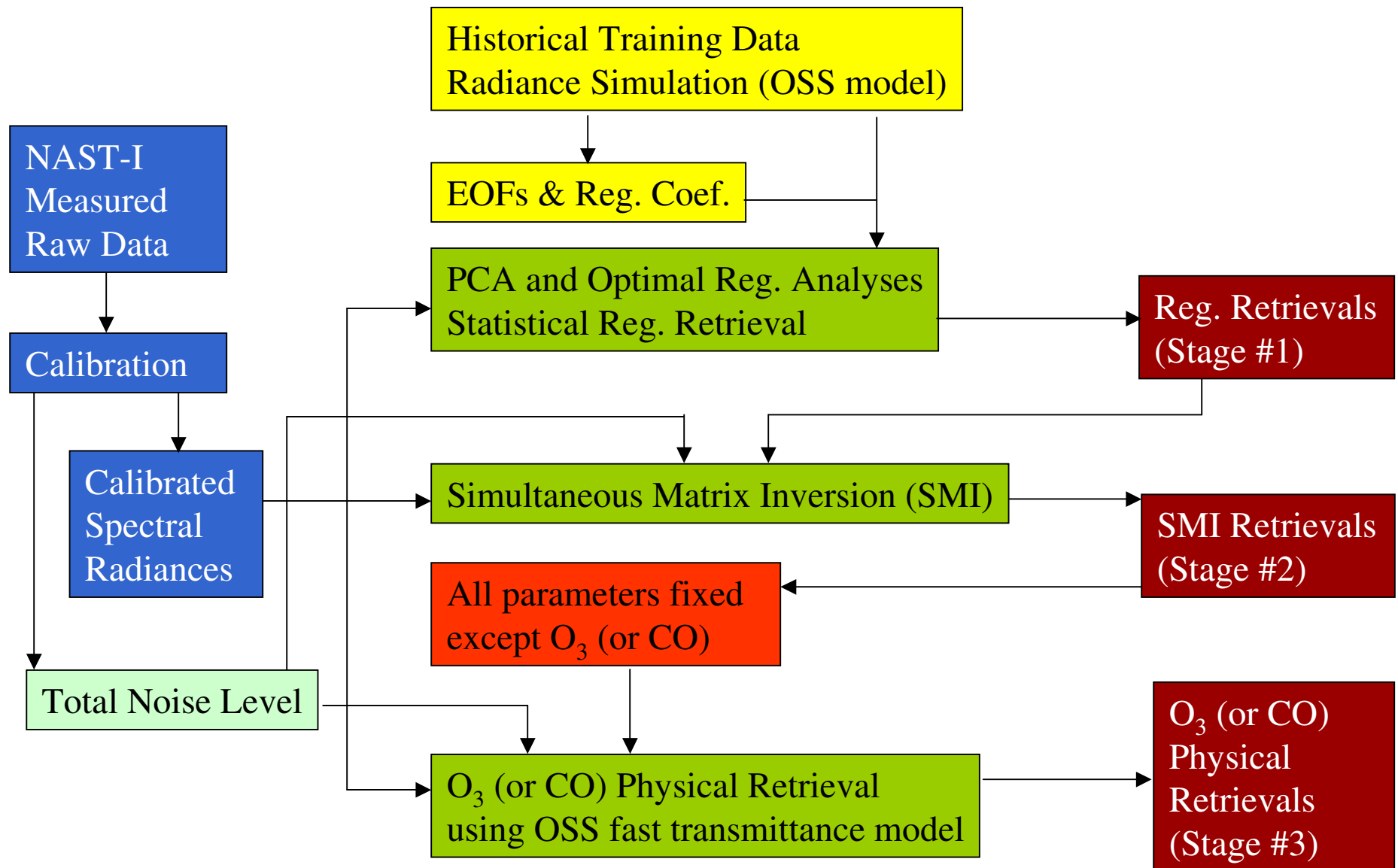
Retrievals (under clear sky conditions)

- Surface skin temperature and emissivity
- Atmospheric temperature and moisture profiles
- Atmospheric O₃ and CO abundances (preliminary)

Retrievals (under cloudy sky conditions)

- Cloud Parameters (i.e., cloud top pressure, temperature, effective cloud amount, particle size, and optical thickness)
- Atmospheric profile above cloud

Flow Diagram for NAST-I O₃ (or CO) Retrieval



NAST-I O₃ and CO Inversion Methodology

Linear Regression Methodology and Analyses (stage 1):

Regression retrieval obtained by using a linear statistical regression of radiance eigenvector amplitudes against atmospheric state parameters based on a historical radiosonde training database. Accurate temperature and water vapor profiles can be achieved from optimal regression (by minimization observed and retrieval simulated radiance).

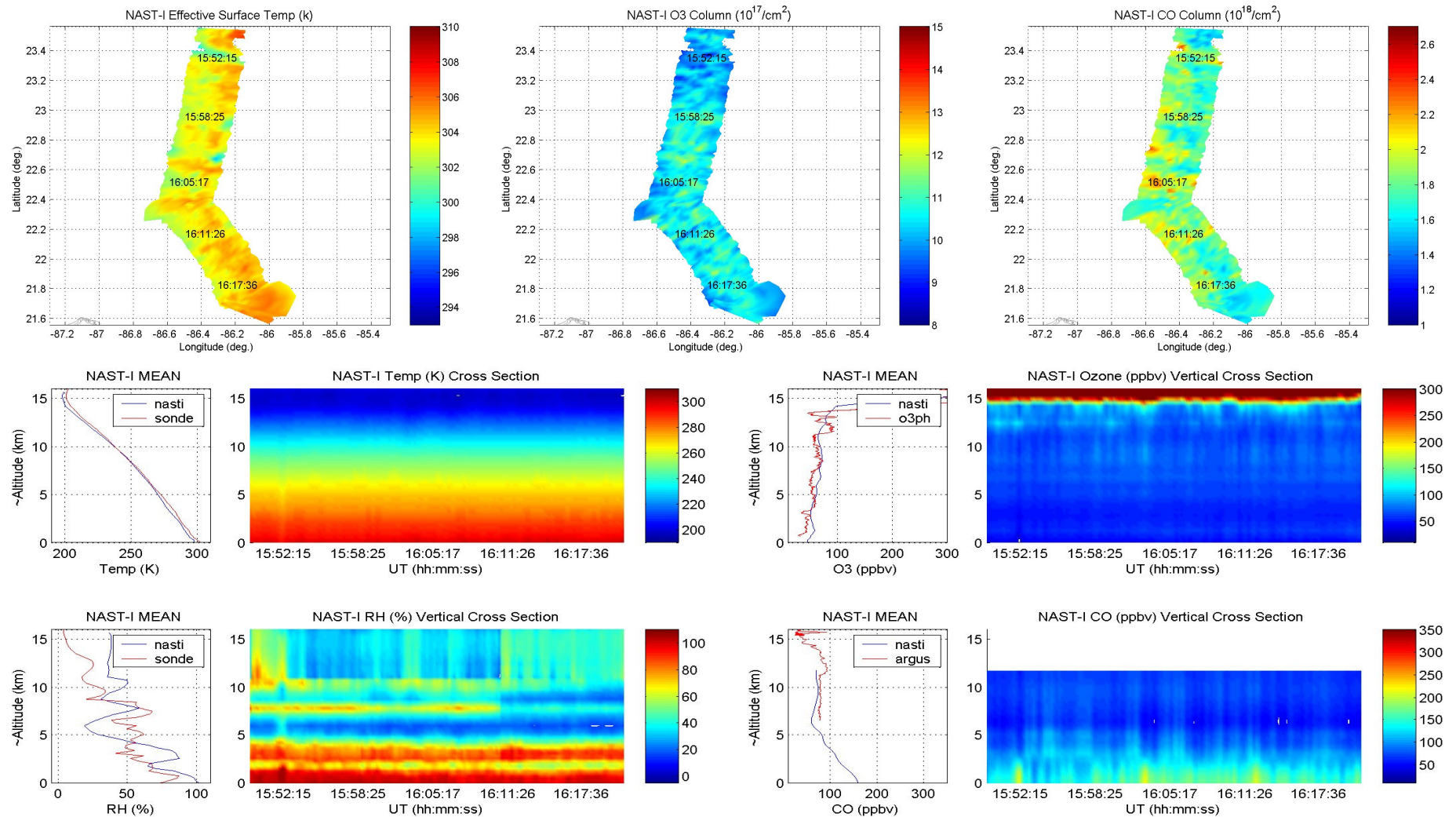
Simultaneous Matrix Inversion Algorithm (stage 2):

Simultaneous matrix inversion achieved using eigenvector regression results as the first guess by iterating the radiative transfer calculations to achieve a solution which best fits the radiance observations (i.e, minimum discrepancy principle).

O₃ and CO Physical Fitting Algorithm (stage 3):

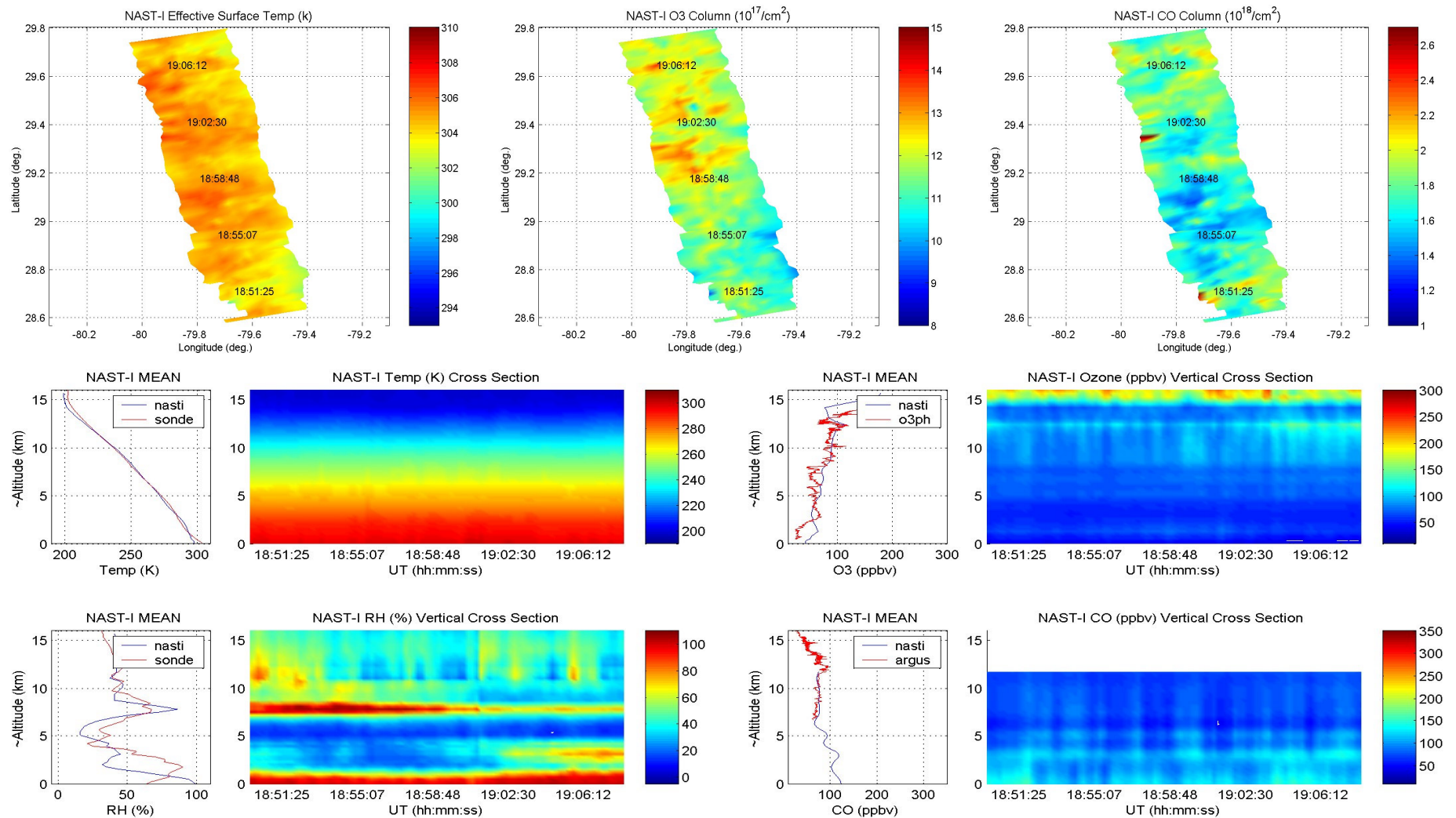
Final O₃ (or CO) retrieved using simultaneous matrix inversion parameters and by iterating the radiative transfer calculations (only O₃ or CO variable) to achieve a solution which best fits the observed radiance (in O₃ or CO spectral region).

C-F NAST-I Results (July 09, 2002)



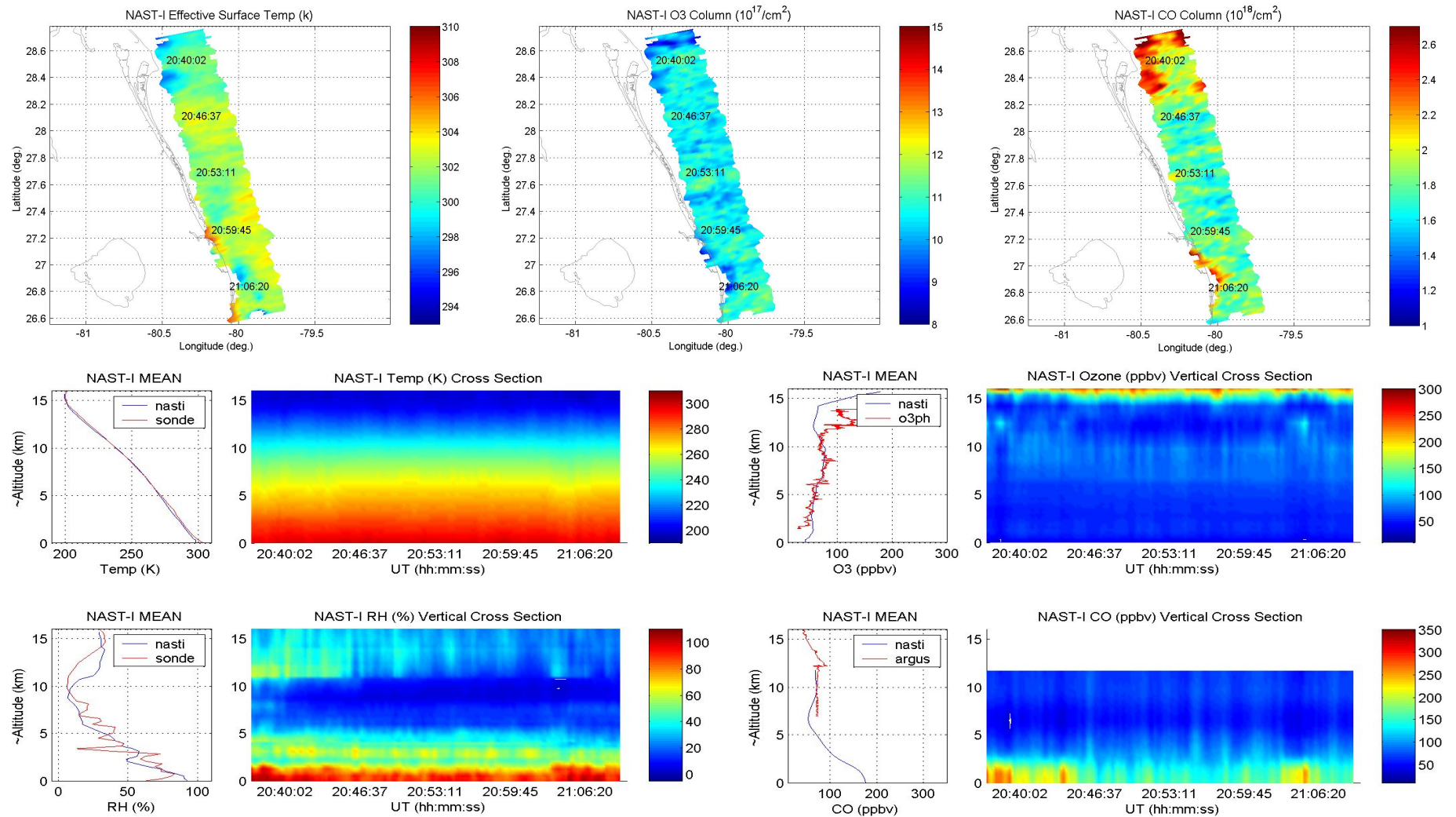
NAST-I results show O₃ and CO column density (from 200 mb to surface) and their vertical cross sections. Temperature and water vapor mean profiles (in blue) are compared with a sonde (in red). NAST-I O₃ and CO mean profiles (in blue) are compared with ozone photometer (red) and Argus CO (red) observed from BW-57 (near Key West, FL), respectively.

C-F NAST-I Results (July 19, 2002)



NAST-I results show O₃ and CO column density (200 mb to surface) and their vertical cross sections. Temperature and water vapor mean profiles (in blue) are compared with a sonde (in red). NAST-I O₃ and CO mean profiles (in blue) are compared with ozone photometer (red) and Argus CO (red) observed from BW-57 (over Key West, FL), respectively.

C-F NAST-I Results (July 26, 2002)



NAST-I results show O₃ and CO column density (from 200 mb to surface) and their vertical cross sections. Temperature and water vapor mean profiles (in blue) are compared with a sonde (in red). NAST-I O₃ and CO mean profiles (in blue) are compared with ozone photometer (red) and Argus CO (red) observed from BW-57 (near Key West, FL), respectively.

Conclusions and Future Work

- **Day to day variations of the temperature, moisture, and trace species were shown in NAST-I retrievals, which are verified by radiosondes (or dropsondes) and BW-57 in-situ measurements.**
- **A preliminary O₃ and CO profile comparison between Proteus NAST-I retrievals and BW-57 in-situ measurements is satisfied in spite of spatial and temporal differences between Proteus and BW-57 aircrafts.**
- **Further forward and inversion analyses and detailed validations will be undertaken.**

Acknowledgments. Ozone and Carbon monoxide in-situ data from BW-57 were kindly provided by Erik C. Richard (NOAA Aeronomy Laboratory and U. Colorado, CIRES) and Max Loewenstein (NASA Ames Research Center).